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(71) Applicant(s):
Cilag AG International
(Incorporated in Switzerland)
Landis + Gyrstrasse 1, CH-6300, Switzerland

(72) Inventor(s):
Nigel David Harrison
Matthew James Brady
Gregory Berman
David Maxwell Johnston
Rosemary Louise Habeshaw

(74) Agent and/or Address for Service:
Carpmaels & Ransford
43 Bloomsbury Square, LONDON, WC1A 2RA, United Kingdom

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INT CL[7] **A61M**
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(54) Abstract Title: **Injection device**

(57) The device has

a housing containing a syringe having a bore extending from an end surface, a needle communicating with the bore through the end surface and a dispensing piston movable in said bore towards said end surface so as to expel the contents of the syringe through the needle, the housing having an opening at one end through which the needle may extend;

a resilient member for biassing the syringe and the needle inwardly of the housing;

a drive element moveable towards said one end so as to move the needle of the syringe out of the opening and to move the dispensing piston of the syringe towards the end surface;

a mechanism operable to release the syringe such that the needle moves inwardly off the housing;

a drive coupling for extending from said drive element to the dispensing piston of the syringe so as to transfer movement of said drive element to the dispensing piston; wherein

the mechanism is triggered to release the syringe and includes components to delay release of the syringe until a predetermined period after being triggered such that it can be ensured that the dispensing piston reaches the end surface before the syringe is released. The mechanism may include an inertial mass movable with the drive element and coupling and a release member actuated by the mass to release the syringe.

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FIG. 1 *(PRIOR ART)*

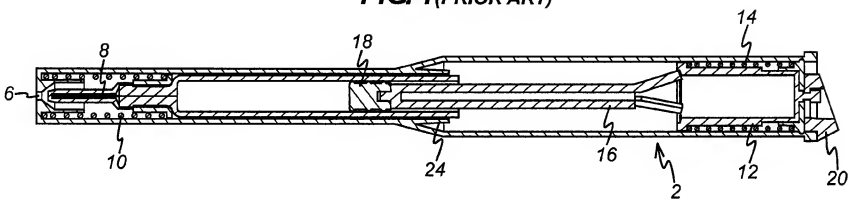


FIG. 2

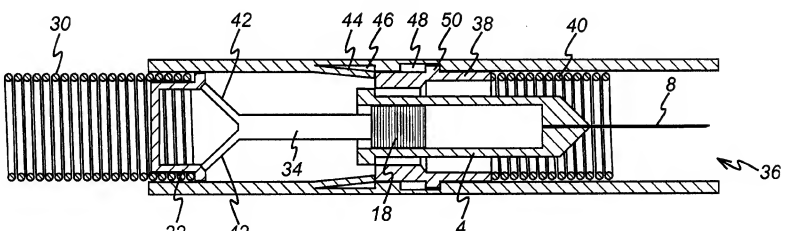


FIG. 3

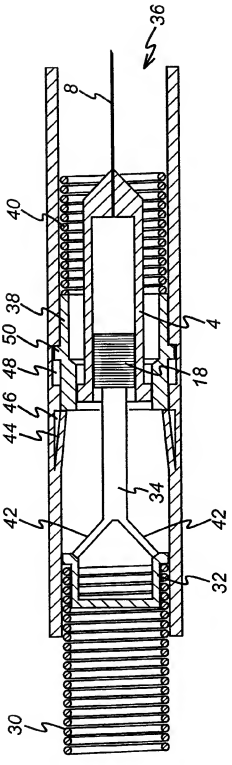


FIG. 4

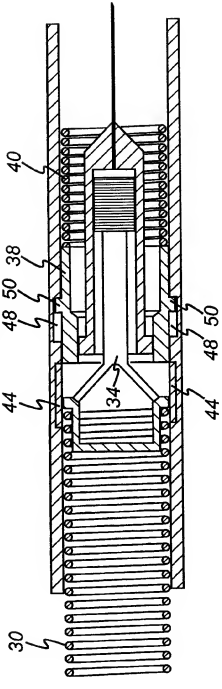


FIG. 5

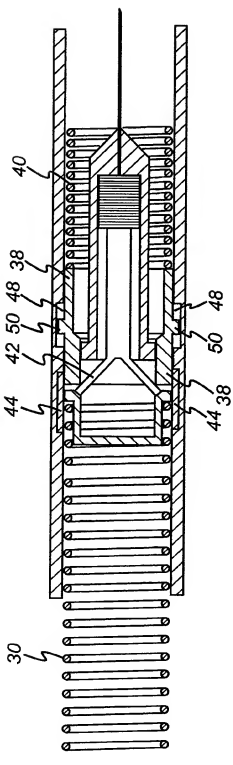


FIG. 6

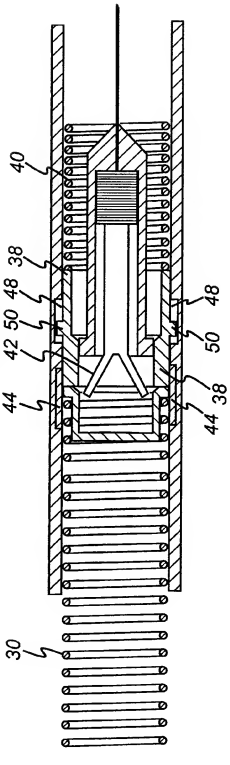


FIG. 7

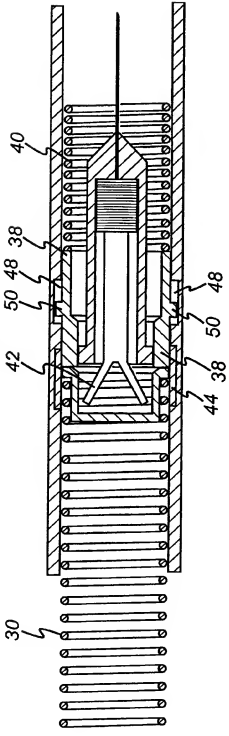


FIG. 8

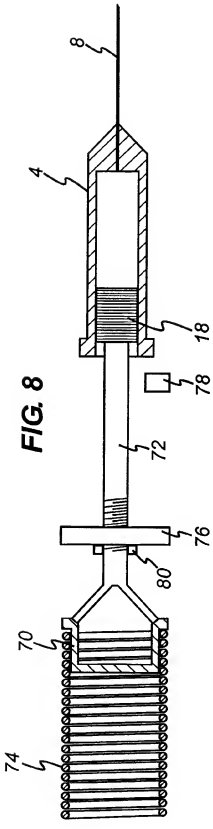


FIG. 9

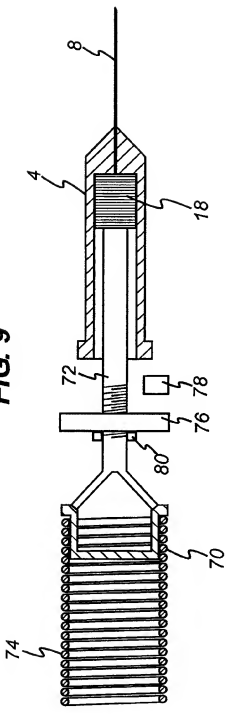
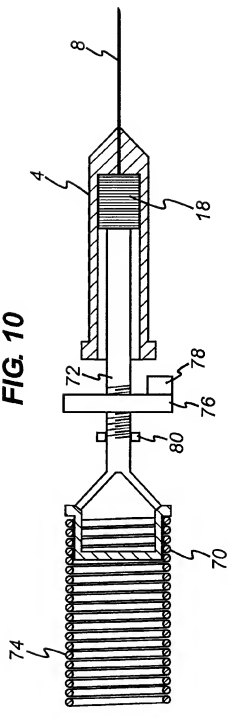


FIG. 10



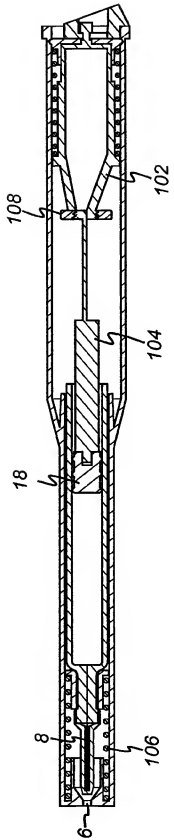


FIG. 11

INJECTION DEVICE

The present invention relates to an injection device, in particular an injection device which, having dispensed the contents of a syringe, automatically retracts the needle of the syringe.

Devices exist which are spring loaded to extend automatically the needle of a syringe from the device, dispense the contents of the syringe and then automatically retract the needle. WO 95/35126 describes such a device.

As illustrated in Figure 1 of the accompanying drawings, the device includes a housing 2 in which a syringe 4 is contained. The housing 2 includes an opening 6 through which the needle 8 of the syringe 4 may extend. A retraction spring 10 biases the syringe 4 away from the opening 6. The device also includes a drive element 12 which is biassed by a spring 14 to drive a coupling 16 to move the dispensing piston 18 of the syringe 4. In use, a release mechanism 20 releases the drive element 12 such that the syringe 4 is first moved forwards and the needle 8 projects through the opening 6. Subsequently, the dispensing piston 18 is moved so as to expel the contents of the syringe 4. The device is designed to include a delatch mechanism. In particular, at the point at which the dispensing piston 18 reaches the end of the bore in the syringe 4, arms 22 at the end of the coupling 16 are deflected by a collar 24 within the housing 2 so as to disengage from the drive element 12. The arms 22 and coupling 16 may then move within a central passage of the drive element 12. As a result, by virtue of the bias of spring 10, the coupling 16 moves inside the drive element 12, the syringe 4 is driven away from the opening 6 and the needle 8 is retracted within the opening 6.

Other similar delatch or retract arrangements have also been proposed. For instance, EP-A-0 516 473 discloses one embodiment in which, at the point at which the dispensing piston reaches the end of the bore in the syringe, a portion of the coupling instantaneously collapses in length as the retraction spring retracts the needle of the spring.

In practice, all of these proposals suffer a problem that, due to a stack up of tolerances of the various manufactured components of the assembled device (the

dimensions of all manufacture components vary around a mean), it cannot be assured that the delatch mechanism will enable retraction of the syringe and needle at precisely the moment at which the dispensing piston reaches the end of the bore. In practice, either the mechanism delatches before the dispensing piston reaches the end of the bore, such that the syringe is not emptied, or the piston reaches the end of the bore before the mechanism has moved sufficiently far to delatch.

Although this problem has been recognised before, for instance in US 6,159,181, the proposed solution has been to provide a user actuated retraction mechanism rather than an automatic one. This is considered to be undesirable.

It is an object of the present invention to provide an injection device which is relatively simple and of low cost (so as to be useful as a single use device) and which overcomes or at least reduces the problems identified above.

According to the present invention there is provided an injection device including:

a housing for containing a syringe having a bore extending from an end surface, a needle communicating with the bore through the end surface and a dispensing piston movable in said bore towards said end surface so as to expel the contents of the syringe through the needle, the housing having an opening at one end through which the needle may extend;

a resilient member for biassing the syringe and the needle inwardly of the housing;

a drive element moveable towards said one end so as to move the needle of the syringe out of the opening and to move the dispensing piston of the syringe towards the end surface;

a mechanism operable to release the syringe such that the needle moves inwardly off the housing;

a drive coupling for extending from said drive element to the dispensing piston of the syringe so as to transfer movement of said drive element to the dispensing piston; wherein

the mechanism is triggered to release the syringe and includes components to delay release of the syringe until a predetermined period after being triggered such

that it can be ensured that the dispensing piston reaches the end surface before the syringe is released.

In this way, the predetermined period of delay can be used to compensate for any stacking of tolerances. It becomes possible to ensure that the dispensing piston has expelled the entire contents of the syringe before the syringe is retracted. It is not necessary for various components to be constructed with critical tolerances to ensure that the syringe is retracted just at the point at which the dispensing piston has fully dispensed the contents of the syringe.

Triggering of the mechanism can be designed to occur whilst the dispensing piston is still moving towards the end surface. Indeed, with movement of the piston available to trigger the mechanism, release of the syringe can be obtained more assuredly. The predetermined delay is designed such that for all variations within the intended tolerances of the components, actual release of the syringe will not occur until after the dispensing piston reaches the end surface.

Preferably, the mechanism is triggered by the relative position of the drive element and/or drive coupling with the housing such that a syringe can be secured within the housing at a position to ensure that the mechanism is triggered before the dispensing piston reaches the end surface.

In this way, the drive element and drive coupling move towards the end of the housing so as to move the dispensing piston towards the end surface and, at a predetermined position along the housing, the mechanism is triggered. This may be achieved by a feature of the drive element or drive coupling interacting with a trigger located on the inside of the housing.

Preferably, the mechanism includes a resiliently biassed release member for releasing the syringe, a trigger member for holding the release member and components for resisting movement of the release member wherein, when the mechanism is triggered, the trigger member releases the release member and the release member moves against the resistance of the components for resisting movement so as to release the syringe.

In this way, although the release member is biassed to move to a position for releasing the syringe, the trigger member holds the release member back. Once the

mechanism is triggered and the trigger member releases the release member, the release member still has to travel to the required position for releasing the syringe. By providing components for resisting movement of the release member, movement of the release member is delayed such that the release of the syringe is also delayed.

Preferably, the components for resisting movement include a damping arrangement.

This is a particularly advantageous way of allowing the release member to move at a predetermined rate and to produce the required delay.

Preferably, the damping arrangement includes a damper for movement against a fluid, such as a liquid or air.

The damper could be provided on one or other of the release member and the housing with a pocket of fluid held in the other of the release member and housing.

Preferably, the drive coupling is disengageable from the drive element and the drive mechanism is operable to disengage the drive coupling from the drive element so as to release the syringe.

Once the drive coupling is disengaged from the drive element, the drive coupling can move relative to the drive element. In particular, the drive coupling may be allowed to move away from the end of the housing such that the resilient member can bias the syringe and needle inwardly of the housing.

Preferably, the drive element comprises an annular wall defining a central through hole and the drive coupling includes resilient arms engageable with the annular wall and deflectable inwardly so as to disengage from the annular wall and allow the drive coupling to move relative to the drive element through the through hole.

This provides a convenient and advantageous arrangement by which the drive coupling can move relative to the drive element and away from the end of the housing.

Preferably, the release member includes a collar moveable within the housing.

The collar may be provided to interact with the drive coupling and/or drive element so as to disengage them. In particular, where one or other of the drive

element and drive coupling includes resilient arms for engaging the drive coupling with the drive element, the collar can be used to deflect the resilient arms inwardly so as to disengage the drive coupling and drive element.

Movement of the collar allows it to be released from a first position upon triggering of the mechanism and move to a second position in which the drive element and drive coupling are disengaged.

Preferably, the components for resisting movement are provided between the collar and the housing.

In this way, movement of the collar can be delayed to provide the required delay for release of the syringe.

Preferably, the trigger member is moveable by the drive element and/or drive coupling from a position to impede movement of the release member and a position to allow movement of the release member.

Hence, the trigger member may take the form of a latch which physically impedes movement of the release member, for instance the collar. One or other of the drive element and/or the drive coupling then physically moves the latch so as to enable the release member to move and then subsequently release the syringe.

According to the present invention, there is also provided an injection device including:

a housing for containing a syringe having a bore extending from an end surface, a needle communicating with the bore through the end surface and a dispensing piston movable in said bore towards said end surface so as to expel the contents of the syringe through the needle, the housing having an opening at one end through which the needle may extend;

a resilient member for biassing the syringe and the needle inwardly of the housing;

a drive element moveable towards said one end so as to move the needle of the syringe out of the opening and to move the dispensing piston of the syringe towards the end surface;

a mechanism operable to release the syringe such that the needle moves inwardly off the housing;

a drive coupling for extending from said drive element to the dispensing piston of the syringe so as to transfer movement of said drive element to the dispensing piston; wherein

the mechanism includes an inertial mass moveable with the drive element and drive coupling and a release member actuable by the inertial mass to release the syringe such that when the dispensing piston reaches the end surface of the syringe and the drive element and drive coupling stop moving, the inertial mass continues to move so as to actuate the release member to release the syringe.

In this way, release of the syringe is not dependent on the relative positions of a number of different components and, hence, is not affected by tolerance stacking. Relative movement of the inertial mass and, hence, release of the syringe occurs as a direct result of the dispensing piston reaching the end surface of the syringe such that it is ensured that the entire contents of the syringe is expelled before the syringe is retracted. It will be appreciated that the inertial mass has a momentum as it moves with the drive element and drive coupling towards the end of the housing. Once the dispensing piston reaches the end surface of the syringe, the dispensing piston stops moving and, hence, the drive element and drive coupling stop moving. The momentum of the inertial mass causes it to continue moving and this movement can be used to actuate the release member to release the syringe.

Preferably, the inertial mass is mounted on at least one of the drive element and drive coupling so as to allow relative movement between the drive coupling in the direction of movement of the drive coupling towards the dispensing piston of the syringe.

In this way, when the dispensing piston reaches the end surface and the drive element and drive coupling stop moving, the inertial mass starts to move relative to at least the drive coupling.

Preferably, the inertial mass is mounted by means of a thread allowing rotation of the inertial mass around the drive element and/or drive coupling.

In this way, rather than have the inertial mass move only with an axial or longitudinal movement relative to the drive coupling, the inertial mass can be caused

additionally to spin or rotate. This allows a more controlled and steady momentum to be set up in the inertial mass and then used subsequently to release the syringe.

Preferably, the injection device further includes a stop which, before use, engages with the inertial mass so as to prevent the inertial mass moving relative to the drive element and drive coupling in a direction away from the dispensing piston.

It will be appreciated that, when the drive element is first moved towards the end of the housing, the inertial mass will be stationary such that it will tend to move relative to the drive coupling in a direction away from the end of the housing. By virtue of frictional effects, the inertial mass will nevertheless start to move to some degree with the drive coupling. However, use of the stop is advantageous, since all movement of the drive element and drive coupling is immediately transferred to the inertial mass. This maximises the amount of energy and momentum available in the inertial mass to release the syringe.

Preferably, the stop is provided on at least one of the drive element and drive coupling.

This is a convenient way of ensuring maximum transfer of momentum.

Preferably, the release member is moveable by said inertial mass to disengage said drive element from said drive coupling so as to allow the syringe to travel away from said one end of the housing.

The drive element may engage with the drive coupling in any convenient manner. For instance, one of the drive coupling and drive element may include an annular wall defining a central through hole and the other of the drive coupling and the drive element may include resilient arms engageable with the annular wall and deflectable inwardly so as to disengage from the annular wall and allow the drive coupling to move relative to the drive element through the through hole. According to the type of engagement chosen, the release member may take any form for disengaging the drive element and drive coupling. For instance, for the example described here, the release member could include a moveable collar acting on the arms to deflect them inwardly.

The release member may be integrally formed with the inertial mass and, before use, connect the drive element to the drive coupling such that, with relative

movement of the inertial mass with the drive coupling, the release member breaks the connection of the drive element and the drive coupling so as to release the syringe.

In other words, the inertial mass may itself form part of a component which joins the drive coupling to the drive element. Once the dispensing piston reaches the end surface and the inertial mass moves relative to the drive coupling, it can be arranged to release the connection between the drive element and drive coupling, thereby allowing retraction of the syringe.

Preferably, the drive coupling and drive element are provided with coaxial threads and the release member is provided with a corresponding thread to connect the drive coupling and drive element.

In this way, when the dispensing piston reaches the end surface, the momentum of the inertial mass will cause it to rotate on its thread relative to the drive coupling, thereby releasing the connection between the drive coupling and the drive element and allowing retraction of the syringe.

The injection device may include a drive spring for biassing said drive element towards the end of the housing. In this case, the release member may be moveable by the inertial mass to disengage the drive spring from the drive element so as to allow the syringe to travel away from the end of the housing.

Release of the engagement between the drive spring and the drive element may be achieved in the same manner as described above for the drive element and drive coupling.

Where the release member is not an integral member of the inertial mass, it may be provided on an inner part of the housing.

The invention will be more clearly understood from the following description given by way of example only, with reference to the accompanying drawings in which:

Figure 1 illustrates a known construction for an injection device;

Figures 2 to 7 illustrate a first embodiment of the present invention at different stages of its operation;

Figures 8 to 10 illustrate a second embodiment of the present invention at different stages of its operation; and

Figure 11 illustrates a variation on the second embodiment.

The present invention can be embodied in any suitable outer housing such as illustrated in Figure 1, in particular having an opening 6 in its end through which the needle 8 of a syringe 4 may extend and a release mechanism 20 at its opposite end for releasing a spring 14 for deploying and emptying the contained syringe.

Figure 2 illustrates schematically the key components of a preferred embodiment for use in a preferred housing.

A drive spring 30 engages with a drive element 32, itself providing drive to a drive coupling 34. The drive coupling 34 is provided to engage the dispensing piston 18 of a syringe 4 in the device. Thus, when the drive coupling 32 is released by an appropriate release mechanism, the drive spring 30 drives the drive element 32 and, hence, the drive coupling 34 towards an end 36 of the housing. As is know, when the drive coupling 34 first pushes upon the dispensing piston 18 of the syringe 4, it will move the syringe 4 itself towards the end 36 of the housing as illustrated in Figure 3. Indeed, the syringe 4 will be moved such that its needle 8 protrudes from the end 36 of the housing so as to penetrate the skin of a user.

As illustrated in Figure 4, further movement of the drive element 32 and drive coupling 34 will cause the dispensing piston 18 to move relative to the cylindrical housing of the syringe 4 and thereby expel the contents of the syringe 4 through the needle 8.

The injection device also includes a mechanism for retracting the syringe 4. Although not illustrated, a spring may be provided to bias the syringe 4 inwardly of the housing and away from the end 36. Once the dispensing piston 18 has reached the end of its travel in the syringe 4, the mechanism may release the syringe such that the spring moves the syringe 4 inwardly of the housing, thereby retracting the needle 8 from the user.

According to the illustrated embodiment, the mechanism includes a release member in the form of a collar 38. The collar 38 is moveable axially within the housing and is biassed away from the end 36 of the housing by means of a spring 40. In this embodiment, collar 38 is designed to interact with resilient arms 42 provided on an end of the drive coupling 34 engaging the drive element 32. The resilient arms

42 interconnect the drive element 32 and drive coupling 34 such that the drive element 32 may push against and transfer movement to the drive coupling 34.

As illustrated in Figure 5, the collar 38 is able to push upon the resilient arms 42 and deflect them inwardly. In this way, as illustrated in Figure 6, the resilient arms 42 are pushed inwardly into a through hole defined within the drive element 32. The syringe 4 is thereby released and can travel as illustrated in Figure 7 so as to retract the needle 8.

According to the present invention, the syringe is not released until a predetermined period after the mechanism is triggered. In this respect, it will be seen in the Figures that at least one trigger member 44 is provided so as to prevent the collar 38 moving by virtue of the spring 40. Hence, in Figures 2 and 3, the collar 38 is held in a position towards the end 36 of the housing. The trigger member(s) 44 are provided adjacent corresponding recesses 46 into which they may be deflected.

As the drive element 32 and drive coupling 34 move towards the end 36 of the housing, at some predetermined position, they deflect the trigger member(s) 44 so as to trigger the mechanism. As illustrated, the trigger member(s) 44 is provided at the outer periphery of the path of the drive element 32. Hence, for this embodiment, the drive element 32 itself deflects the trigger member(s) outwardly. However, it should be appreciated that other similar trigger members could be provided which are deflected either by the drive element 32 or the drive coupling 34.

As illustrated in Figure 4, with the trigger member(s) deflected into the corresponding recess(es) 46, the collar 38 is free to move away from the end 36 of the housing under the power of spring 40 so as to deflect the resilient arms 42 and release the syringe 4 as described above.

It will be appreciated that there will be a predetermined time interval between deflection of the trigger member(s) 44 and deflection of the resilient arms 42 due to the time taken for the collar 38 to move. During this predetermined time interval, the drive element 32 and drive coupling 34 will continue to move the dispensing piston 18 towards the end surface of the syringe 4. Indeed, in the preferred embodiment, the components are designed such that the trigger member(s) 44 are deflected and the mechanism is triggered before the dispensing piston 18 reaches the end surface of the

syringe 4 (see Figure 4), but that the syringe 4 is not released until after the dispensing piston 18 reaches the end surface of the syringe 4. In this embodiment, this is when the resilient arms 42 are deflected (see Figures 5 and 6).

Although it is possible to rely on frictional forces to resist movement of the collar 38 and thereby introduce the desired delay, in the preferred embodiment, a damping arrangement is provided.

As illustrated in Figures 2 to 7, the housing is provided with a damping pocket 48 within which a damper 50 on the outer periphery of the collar 38 may move. In this respect, it should be appreciated that the arrangement of pocket and damper between the housing and collar can be reversed.

The pocket 48 may be filled with a damping fluid, such as a liquid, or may rely merely on movement of a gas, such as air. Once the collar 38 is released by the trigger member(s) 44, the damping arrangement, 48, 50 resists movement and thereby provides an increased delay before the syringe 4 is released. As explained above, this can be used to ensure that the dispensing piston 18 has fully expelled the contents of the syringe 4 before the syringe 4 is released.

While a particular embodiment has been described, it should be appreciated that a large number of variations may be introduced.. It is not necessary for the release member to be a collar or, indeed, the collar 38 might rotate instead of or as well as move axially. Furthermore, any other form of damping suitable for the release member may be used and, as mentioned above, different forms of trigger member are also possible.

Figures 8, 9 and 10 illustrate schematically key components of an alternative embodiment. Once again, these components can be embodied in an overall housing such as illustrated in Figure 1 with an equivalent release mechanism. Also, many of the features described with reference to Figures 2 to 7 could also be used with this embodiment to disconnect the drive spring from the drive element, or the drive element from the drive coupling so as to enable retraction of the syringe under the power of a retraction spring.

As with previous arrangements, a drive element 70 engages with a drive coupling 72 which in turn engages with the dispensing piston 18 of a syringe 4. A

drive spring 74 may be provided to move the syringe 4 towards an end of the housing so as to extend the needle 8 of the syringe 4 and subsequently to move the dispensing piston 18 within the syringe 4 so as to expel the contents of the syringe 4.

Although not illustrated, a resilient member such as a spring may also be provided to bias the syringe and needle inwardly of the housing such that, at an appropriate time, the syringe 4 and needle 8 may be retracted back into the housing.

A mechanism is provided whereby the syringe 4 is released at an appropriate time so that the resilient member can retract the syringe 4. Details of the components which hold the syringe and release it are not essential to the invention. Components such as described above and other known mechanisms may be used. However, the present invention proposes a novel and inventive arrangement for triggering retraction of the syringe 4.

In the embodiment illustrated in Figures 8 to 10, an inertial mass 76 is mounted on the drive coupling 72.

When the drive element 70 and drive coupling 72 move forwards so as to move the dispensing piston 18 and expel the contents of the syringe 4, the inertial mass 76 moves with them. However, when the dispensing piston 18 reaches the internal end surface of the syringe 4 as illustrated in Figure 8, the drive element 70 and drive coupling 72 stop moving relatively abruptly. Due to the momentum of the inertial mass 76, the inertial mass 76 continues to move forwards.

As illustrated, a trigger 78 is provided in the device for actuating the retraction mechanism. In particular, the inertial mass 76 will move from its original position on the drive coupling 72 to a position where it will operate the trigger 78 and thereby actuate the retraction mechanism.

It will be appreciated that a substantial number of variations are possible. The inertial mass could be mounted on the drive element 70 or, indeed, it could be mounted on a separate component which also moves with the dispensing piston 18. The important point is of course that the inertial mass should move to actuate the retraction mechanism in response to the dispensing piston 18 stopping.

Similarly, the trigger 78 can take any appropriate form and can be mounted anywhere within the housing, for instance on the housing wall or on the drive

coupling 72. The nature of the trigger 78 may vary according to the particular retraction mechanism used.

In the illustrated embodiment, a stop 80 is provided behind the inertial mass 76. The stop 80 functions to push the inertial mass 78 forwards when the drive element 70 and drive coupling 72 first start moving forwards so as to move the syringe 4 and dispensing piston 18. It will be appreciated that, at this point in the operation of the device, there will be a tendency for the inertial mass 76 to move backwards away from the dispensing piston 18 due to its inertia. By providing the stop 80, the inertial mass 76 is positively driven forwards with the drive coupling 72 such that the energy and momentum provided to the inertial mass 76 is maximised. This similarly maximises its ability to operate the trigger 78.

The stop 80 may be a separate component or be formed as an integral part of the mounting for the inertial mass. For instance, where the inertial mass is able to move relative to the drive coupling along a channel, the channel might only start at a predetermined position along the length of the drive coupling 72 such that the end wall of the channel forms the stop.

In the preferred embodiment, the inertial mass 76 is mounted rotatably by means of a thread. In the illustrated embodiment, the inertial mass 76 may have a female thread engaging with a corresponding male thread around the drive coupling 72. However, as mentioned above, the inertial mass 76 could alternatively be mounted on other components.

In this way, when the dispensing piston 18 reaches the end of its travel and the inertial mass 76 starts to move relative to the drive coupling 72, the inertial mass will rotate or spin as well as move forwards towards the dispensing piston 18. This rotation provides a rotational inertia or momentum which is more controlled and sustains over a longer period of time. In particular, it can be more effective in providing assured actuation of any trigger.

In alternative embodiments, the inertial mass and release member may be integrated so as to themselves form the retraction mechanism. In particular, the release member may take the form of a thread which joins the drive element to the drive coupling.

An embodiment is illustrated in Figure 11.

When the dispensing piston 18 reaches the end of its travel and stops, the inertial mass 108 continues to move and hence rotates about the drive element 102 and drive coupling 104 such that its thread forming the release member unscrews from the threads joining the drive element 102 and the drive coupling 104. Once the thread has fully unscrewed then drive coupling 104 is able to move relative to the drive element 102 and the syringe 4 is retracted by means of the resilient member 106.

Similar alternative arrangements are also possible

CLAIMS

1. An injection device including:

a housing for containing a syringe having a bore extending from an end surface, a needle communicating with the bore through the end surface and a dispensing piston movable in said bore towards said end surface so as to expel the contents of the syringe through the needle, the housing having an opening at one end through which the needle may extend;

a resilient member for biassing the syringe and the needle inwardly of the housing;

a drive element moveable towards said one end so as to move the needle of the syringe out of the opening and to move the dispensing piston of the syringe towards the end surface;

a mechanism operable to release the syringe such that the needle moves inwardly off the housing;

a drive coupling for extending from said drive element to the dispensing piston of the syringe so as to transfer movement of said drive element to the dispensing piston; wherein

the mechanism is triggered to release the syringe and includes components to delay release of the syringe until a predetermined period after being triggered such that it can be ensured that the dispensing piston reaches the end surface before the syringe is released.

2. An injection device according to claim 1 wherein the mechanism is triggered by the relative position of the drive element and/or drive coupling with the housing such that a syringe can be secured in the housing at a position to ensure that the mechanism is triggered before the dispensing position reaches the end surface.

3. An injection device according to claim 1 or 2 wherein the mechanism includes a resiliently biassed release member for releasing the syringe, a trigger member for holding the release member and components for resisting movement of the release member wherein, when the mechanism is triggered, the trigger member

releases the release member and the release member moves against the resistance of the components for resisting movement so as to release the syringe.

4. An injection device according to claim 3 wherein the components for resisting movement include a damping arrangement.

5. An injection device according to claim 4 wherein the damping arrangement includes a damper for movement against the fluid such as a liquid or air.

6. An injection device according to any preceding claim wherein the drive coupling is disengageable from the drive element and the mechanism is operable to disengage the drive coupling from the drive element so as to release the syringe.

7. An injection device according to claim 6 wherein the drive element comprises an annular wall defining a central through hole and the drive coupling includes resilient arms engageable with the annular wall and deflectable inwardly so as to disengage from the annular wall and allow the drive coupling to move relative to the drive element through the though hole.

8. An injection device according to any preceding claim wherein the release member includes a collar moveable within the housing.

9. An injection device according to claim 8 when appendent on claim 3 wherein the release member includes a collar moveable within the housing and the components for resisting movement are provided between the collar and the housing.

10. An injection device according to any preceding claim wherein the trigger member is moveable by the drive element and/or the drive coupling from a position to impede movement of the release member and a position to allow movement of the release member.

11. An injection device including:

a housing for containing a syringe having a bore extending from an end surface, a needle communicating with the bore through the end surface and a dispensing piston movable in said bore towards said end surface so as to expel the contents of the syringe through the needle, the housing having an opening at one end through which the needle may extend;

a resilient member for biassing the syringe and the needle inwardly of the housing;

a drive element moveable towards said one end so as to move the needle of the syringe out of the opening and to move the dispensing piston of the syringe towards the end surface;

a mechanism operable to release the syringe such that the needle moves inwardly off the housing;

a drive coupling for extending from said drive element to the dispensing piston of the syringe so as to transfer movement of said drive element to the dispensing piston; wherein

the mechanism includes an inertial mass moveable with the drive element and drive coupling and a release member actuable by the inertial mass to release the syringe such that when the dispensing piston reaches the end surface of the syringe and the drive element and drive coupling stop moving, the inertial mass continues to move so as to actuate the release member to release the syringe.

12. An injection device according to claim 11 wherein the inertial mass is mounted on at least one of the drive element and the drive coupling so as to allow relative movement with the drive coupling in the direction of the movement of the drive coupling towards the dispensing piston of the syringe.

13. An injection device according to claim 11 or 12 wherein the inertial mass mounted by means of a thread allowing rotation of the inertial mass around the drive element and/or drive coupling.

14. An injection device according to claim 11, 12 or 13 further including a stop which, before use, engages with the inertial mass so as to prevent the inertial mass moving relative to the drive element and drive coupling in a direction away from the end of the housing.

15. An injection device according to claim 14 wherein the stop is provided on at least one of the drive element and drive coupling.

16. An injection device according to any one of claims 11 to 15 wherein the release member is moveable by said inertial mass to disengage said drive element from said drive coupling so as to allow the syringe to travel away from said one end of the housing.

17. An injection device according to claim 16 wherein the release member is integrally formed with the inertial mass and, before use, connects the drive element to the drive coupling such that, with relative movement of the inertial mass with the drive coupling, the release member disconnects the connection of the drive element and the drive coupling so as to release the syringe.

18. An injection device according to claim 17 wherein the drive coupling and drive element are provided with coaxial threads and the release member is provided with a corresponding thread to connect the drive coupling and drive element.

19. An injection device according to any one of claims 11 to 16 further including a drive spring for biassing said drive element towards said one end of the housing wherein the release member is moveable by said inertial mass to disengage the drive spring from said drive element so as to allow the syringe to travel away from said one end of the housing.

20. An injection device according to any one of claims 11 to 16 and 19 wherein the release member is mounted on said housing.

21. An injection device constructed and arranged substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

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Claims searched:	All
Examiner:	Michael R. Wendt
Date of search:	30 June 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
A	1 at least	WO 00/64515 A1	(JELLESEN) e.g. see Figure 1 & Claim 1;
A	----"----	WO 99/53979 A1	(& US 6159181 **mentioned in the application**) (MUMFORD) e.g. see Figures 1 - 6; page 4 lines 12 etc;
A	----"----	WO 95/35126 A1	(SAFE-T) **mentioned in the application** e.g. see Abstract & Figures.
A	----"----	EP 0516473 A1	(MUMFORD) **mentioned in the application** e.g. see Claim 1 & Figures.
A	----"----	US 6179812 B1	(MDC) e.g. see Claim 1; Figure 1; Column 3 lines 33 etc. Abstract.
A	----"----	US 6015438	(RETRACTABLE T.) e.g. see Claim 1; Column 3 lines 20 etc; Figures.

Categories:

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Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

A5R

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A61M

The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI, Japio